

Status of the Antiproton Source

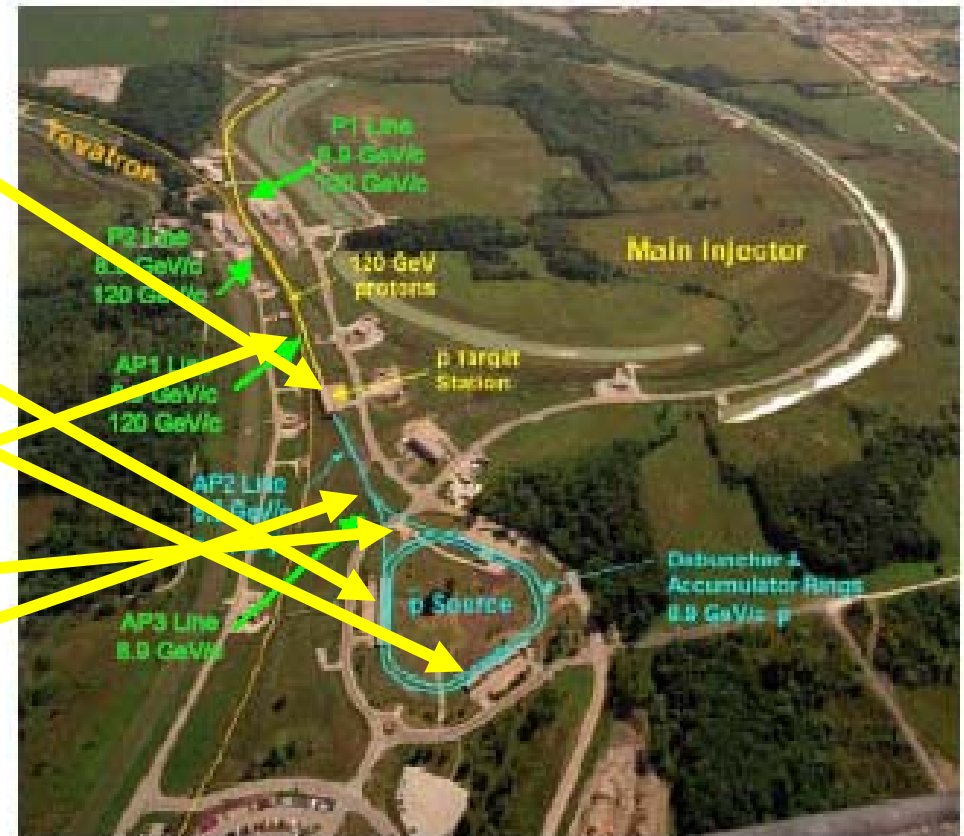


- Introduction to Pbar
- Shutdown work
- Stacking performance and prospects
- Other Considerations
- Summary

Introduction



- Target Station
- Debuncher
- Accumulator
- Beam lines
 - AP1 (120 & 8 GeV)
 - AP2 (8 GeV secondaries)
 - AP3 (8 GeV)

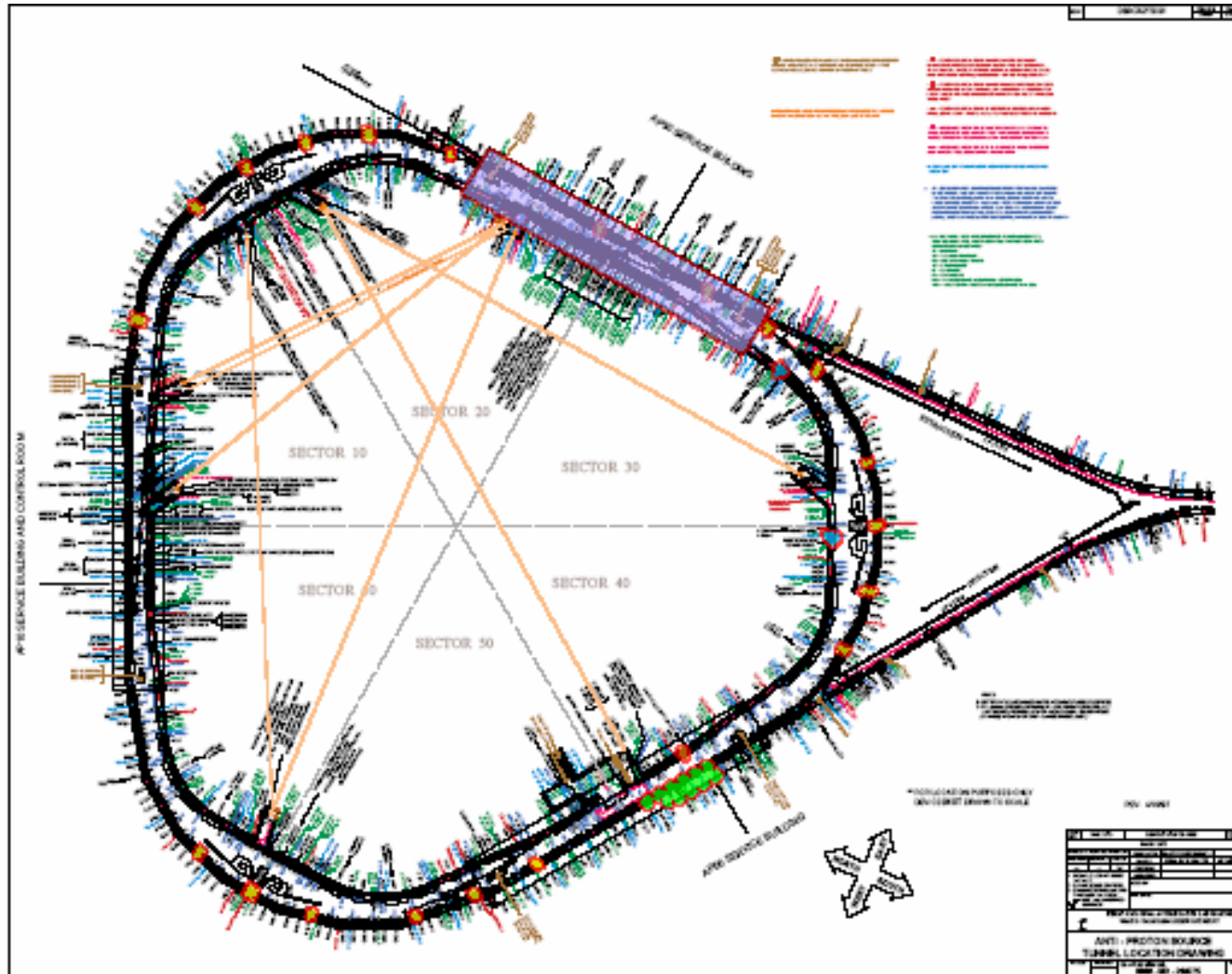


Shutdown Work



- Planned Focus
 - Run II Upgrades - Improvements to Stacking
 - Debuncher Motorized Quadrupole Stands
 - Debuncher Injection region
 - Beam line alignment
 - Expanded scope of work
 - SO cord remediation
 - ARF1 cavity
 - Accumulator Flying wire repair
 - D to A line
 - Stochastic Cooling Tank vacuum
 - AP2 beam stop
 - Easily filled 13 weeks

Shutdown Work



Users Executive Committee
E. Harms

Shutdown Work



- Debuncher Motorized Quads
 - Additional 20 quads
 - 10 already outfitted
 - 114 quads total in Debuncher
 - Beam-based alignment
 - Orbit control/aperture maximization around entire Ring

Shutdown Work



Shutdown Work



- Injection region
 - More tuning space in a historical bottleneck
 - Modified Injection Septum
 - 1 SQC replaced with 2 LQB's
 - Larger beam pipes
 - Motorized stands to optimize positions

Shutdown Work



Shutdown Work



- Alignment
 - Tie Pbar into modern TevNet
 - Relative alignment of beam lines with respect to each other
 - AP1, AP2, Debuncher, ...
 - Analysis in progress, should be complete in March
 - Additional jobs

Shutdown Work

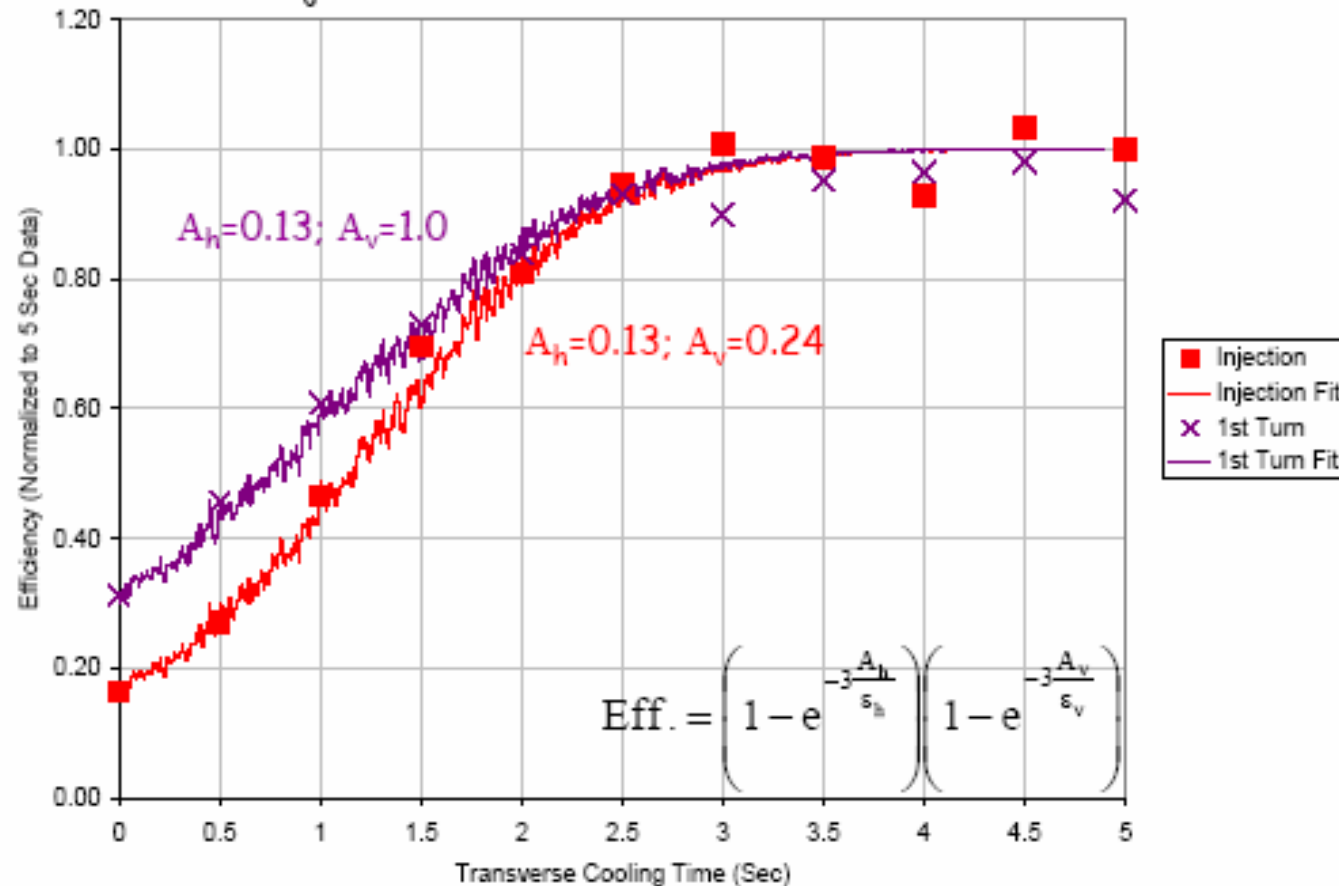


- D to A line
 - Perceived to be a stacking limitation near beginning of shutdown
 - Transfer area 'as found' with laser tracker
 - Magnet septum magnets moved horizontally
 - One septum replaced

Stacking Performance & Prospects



- The production vs transverse cooling time measurements can be explained if there is an aperture restriction between Debuncher Extraction and Accumulator Injection



Shutdown Work



- AP2 beam stop
 - Vacuum problem developed last year presumably inside target vault
 - Beam stop found to be misaligned, likely since original installation
 - Temporary one installed in AP2, target vault shielding modified

Shutdown Work



Stacking Performance & Prospects



- Rapid Startup
 - Stacking 'back to normal' within two weeks of first beam
 - Luminosity produced 10 days after start up
- Record Stacking in the past month
 - Peak rate for one hour = $14.97 \times 10^{10}/\text{hour}$
 - Still well short of goal

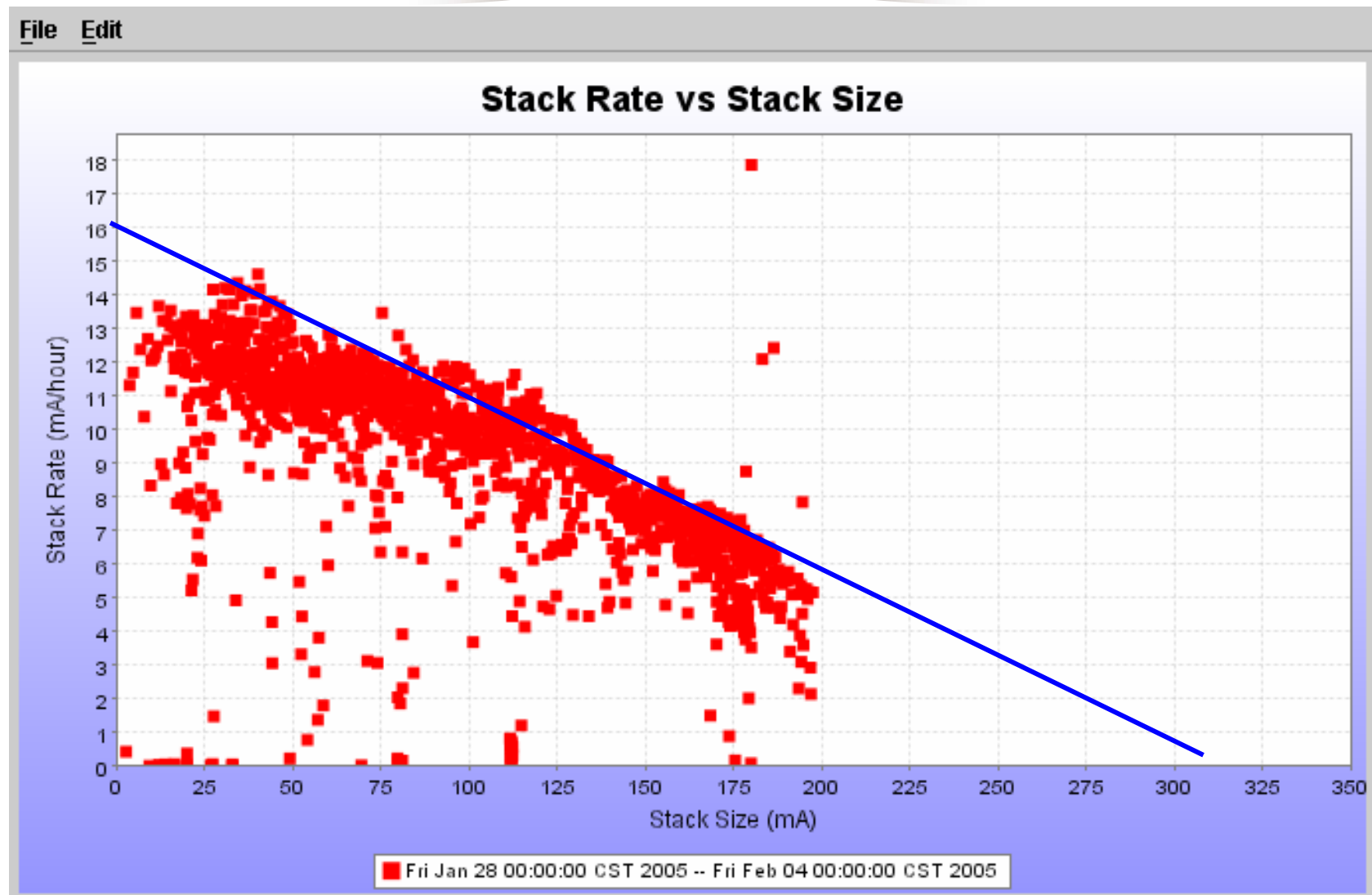
Stacking Performance & Prospects



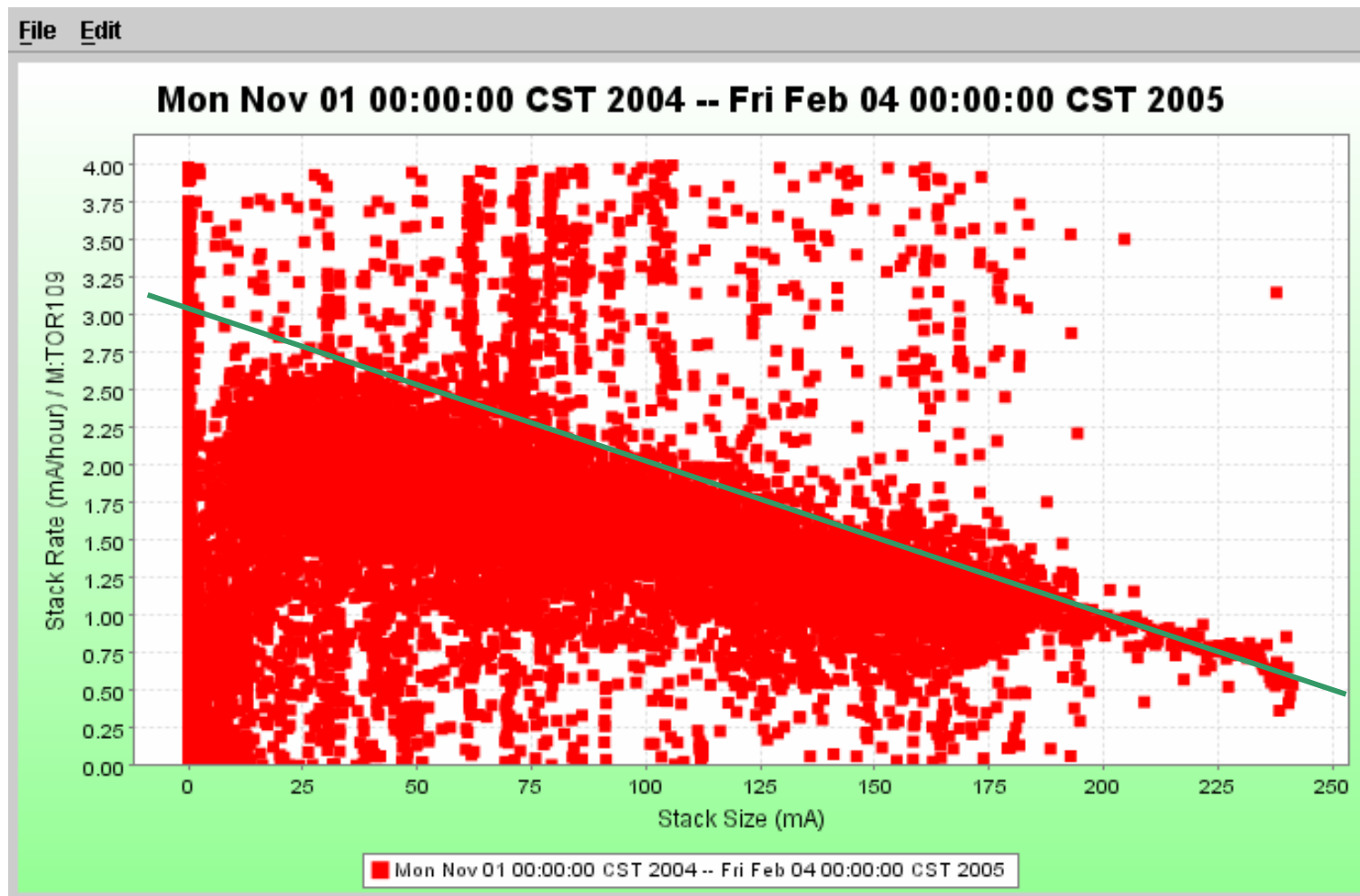
- FY05 Goals

Parameter	FY05 Design	FY05 Base	FY05 best	
Zero Stack Stacking Rate	24.5	14	16	$\times 10^{10}/\text{hour}$
Normalized Zero Stack Stacking Rate	3.1	2.3	3.0	$\times 10^{-2}/\text{hour}$
Average Stacking Rate	10.1	6.6	9.61 (averaged for one week)	$\times 10^{10}/\text{hour}$
Stack Size at Zero Stacking Rate	300	300	310	$\times 10^{10}$
Protons on Target	8.0	6.2	7.2	$\times 10^{12}$
Peak Stack	216	181	241.6	$\times 10^{10}$
Unstacked Pbars	201	166	171	$\times 10^{10}$

Stacking Performance & Prospects



Stacking Performance & Prospects



Stacking Performance & Prospects

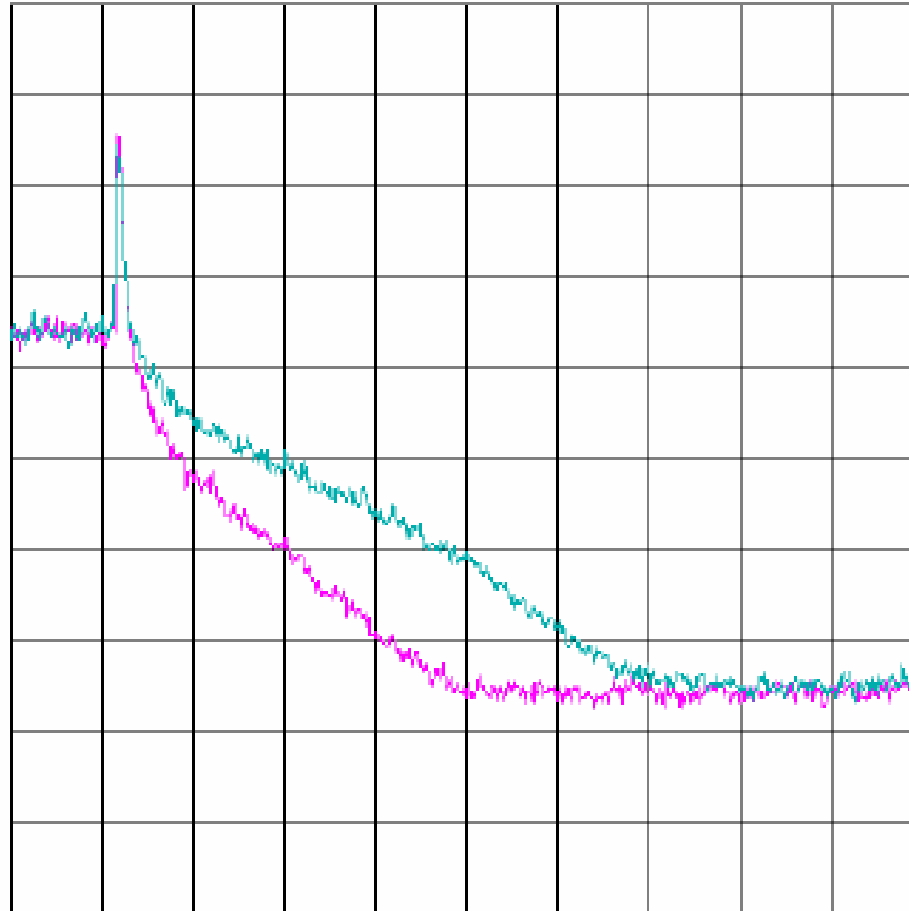


- Prospects for improvement
 - Stochastic cooling systems are able to handle flux in support of stacking to goal
 - can clear Accumulator deposition orbit in 1.2 seconds
 - Make use of more beam on target from slip stacking
 - Main gains via
 - Cycle time reduction
 - Bigger aperture/more flux > Beam-based alignment

Stacking Performance & Prospects



SPL2 SCH WITH GAIN AT 10.5 DB



Start Freq 2.508206848 GHz

Stop Freq 2.508206848 GHz

85/19/84 2245

Scale 5 dB/div

Atten 8 dB

Sup 3 sec

Vid BW 38 Hz

Res BW 18 KHz

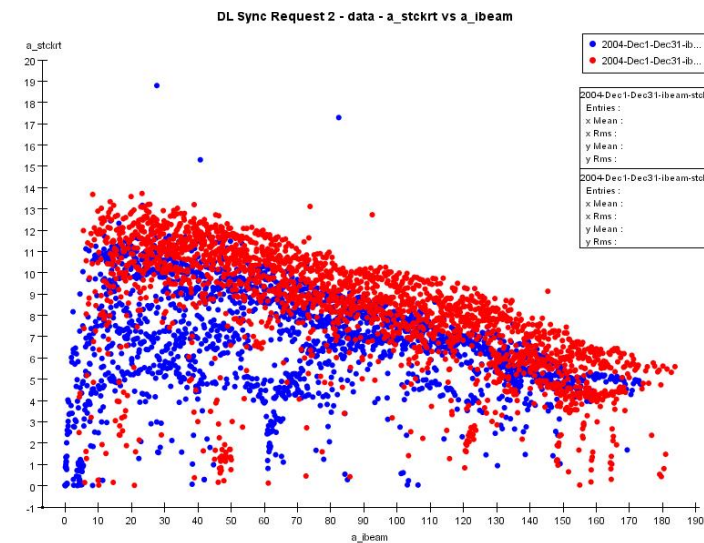
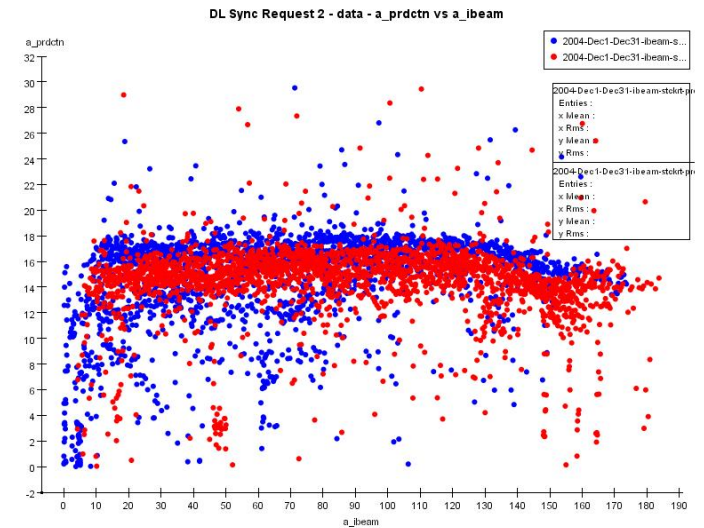
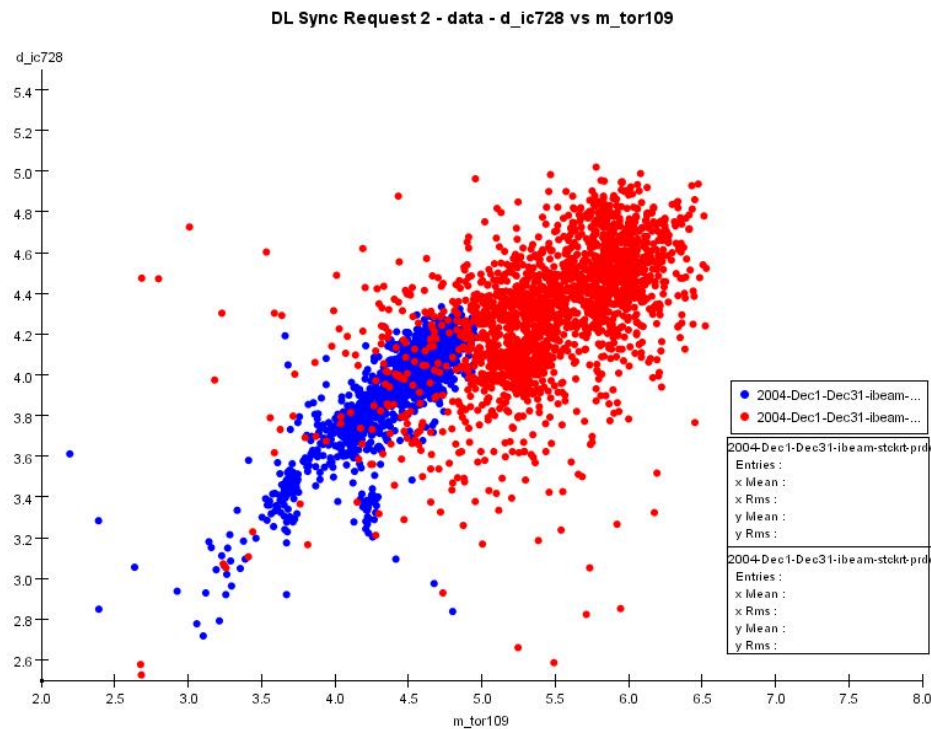
Ref Lvl -69 dB

- With no core in the Accumulator, the rate at which the Stacktail moves beam off the deposition orbit was measured

Cyan Trace with attenuator at 10.5 dB clears in 1.8 secs

Magenta Trace with attenuator at 4.5 dB clears in 1.2 secs

Stacking Performance & Prospects



Slip Stacking
Stacking

Stacking Performance & Prospects



- Develop tools to exploit installed components
- Work in progress
 - Build/verify Debuncher orbit bumps with additional quad stands (half complete)
 - Use to explore/expand aperture
 - Beam bunching gymnastics
 - Allow some parasitic tuning and studies while stacking
 - Optimize injection into Debuncher
 - D/A line diagnostics
 - AP2 BPM system
 - TBT systems

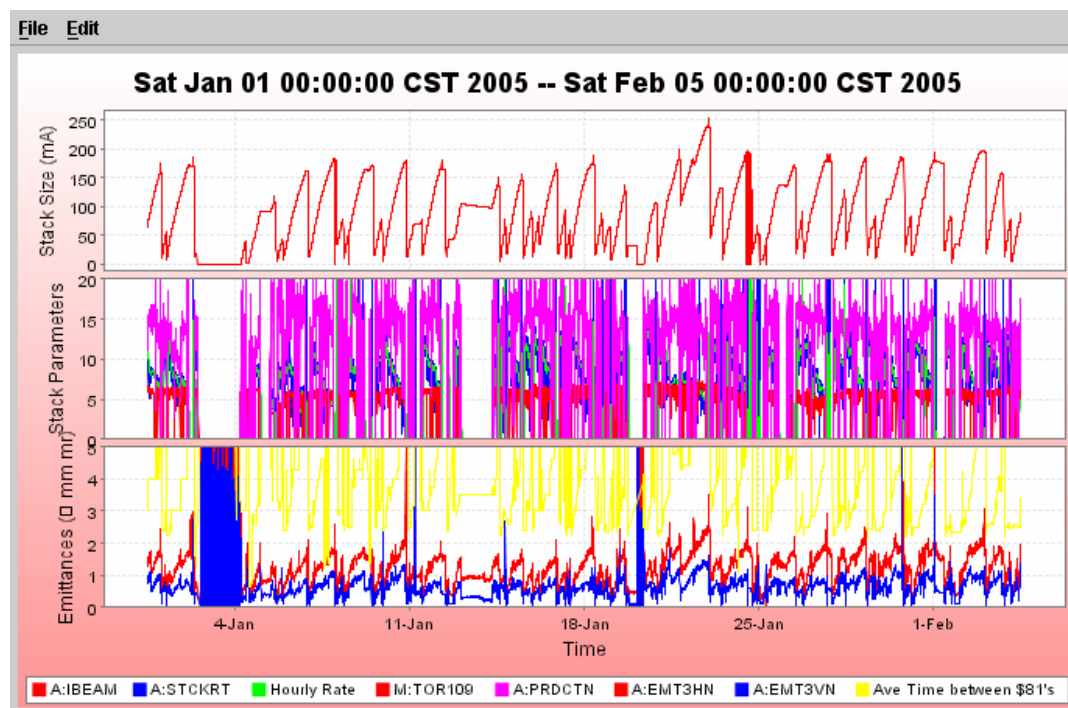
Stacking Performance & Prospects



- Short-term plans (typical)
 - Reduce Accumulator circulating beam loss
 - Explore the Debuncher aperture during stacking
 - Perform reverse proton studies as time allows
 - DEXBMP preparation
 - 1 hr
 - Verify remaining Debuncher bumps
 - 4-6 hrs
 - AP2 vertical injection alignment
 - 16-30 hrs in at least 6 hr chunks
 - AP2 horizontal injection alignment
 - 6-12 hrs

Other Considerations

- Support day-to-day Collider operation
 - Regularly have fires to put out
 - Identify incremental improvements
- Reliability



Other Considerations



- Frequent Transfers
 - Recycler shots enhance \mathcal{L}_0 , but not $\int \mathcal{L}$ except for long stores (~30 hours)
 - Stacking faster will lead to enhancement
 - Off-loading to the Recycler more rapidly is beneficial
 - balancing act with time to transfer, Recycler capabilities, etc.
 - As stacking rate increases & Electron cooling is commissioned, Frequent transfers a must

Other Considerations

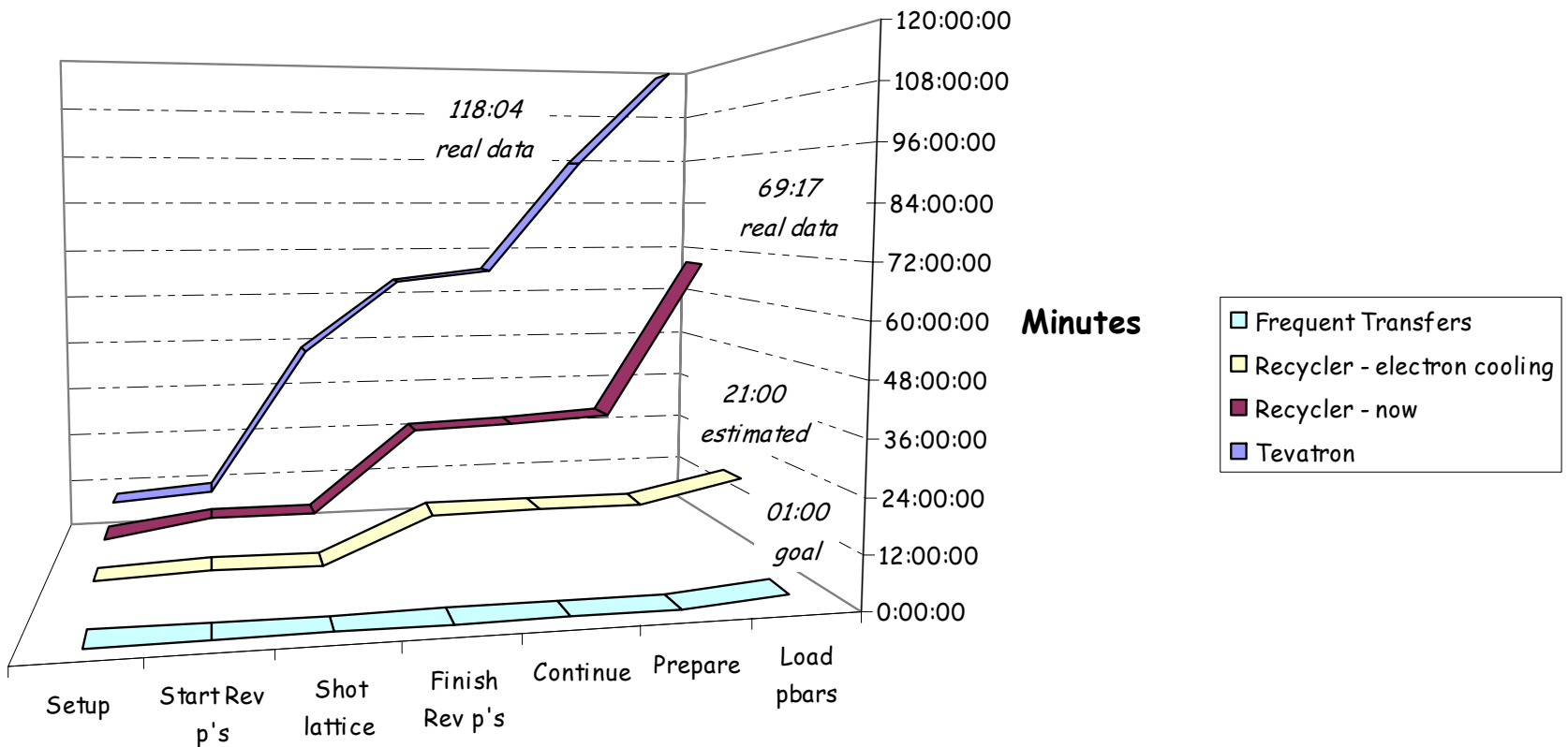


- With the Recycler and electron cooling integrated into Collider operation and high stacking rates, frequent transfers will be vital
 - Unstack and transfer every 30 minutes/ 40×10^{10} stack
 - Interrupt stacking for ~ minutes
- Three cornerstone segments should be complete this spring
 - Ramped AP1 power supplies
 - Beam line BPM upgrade
 - MI transverse Injection dampers for Pbars
- Utilize upgrades as opportunity arises
 - Faster/more frequent Recycler transfers (<30 minutes stacking - stacking) this spring
 - No Reverse protons for routine transfers?
 - Incrementally faster Tevatron shots?

Other Considerations



Comparative Shot Set Up Times



Summary



- Lots of work completed during shutdown
- Came back on well
- Improvement in Stacking to date
 - Slip stacking
- Improved stacking is our priority
 - Cycle time
 - Cooling ok
 - D to A transfers
 - Injection Aperture/Flux
- Long list of items to pursue as beam time & expanding suite of tools and diagnostics are available